

Increasing the Frequency Response of the ADXL50

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The ADXL50 is specified and tested for operation over the range from dc to 1.3 kHz typically. However, in many applications, such as vibration monitoring, a wider bandwidth is required. The bandwidth of the ADXL50 can be increased by changing the demodulator capacitor.

The ADXL50 is a closed-loop forced feedback accelerometer (for theory of operation see the data sheet). The sensor acts as a well behaved single-pole system. The demodulator capacitor sets the dominant pole for the system and thus the -3 dB bandwidth of the control loop. The -3 dB bandwidth scales with the inverse of the capacitor value, i.e., halving the capacitor will double the -3 dB bandwidth. The sensor beam has a resonance at approximately 24 kHz. Thus at higher frequencies the single-pole response is affected by this resonance.

The ADXL50 can be used up to 10 kHz where there is adequate phase margin to ensure stable operation. However, if an input pulse or shock signal has energy at the resonant frequency, this signal will be amplified and cause a damped ringing response. Figure 1 illustrates the effect of decreasing the demodulator capacitor for a typical ADXL50.

Some temperature and part-to-part variation may occur. Temperature variation will change the -3 dB point by typically 4%; low temperature coefficient capacitors should be used. Part-to-part variation can be as much as $\pm 42\%$. Therefore, it is not recommended to use a demodulator capacitor value below 0.005 μF to ensure system stability.

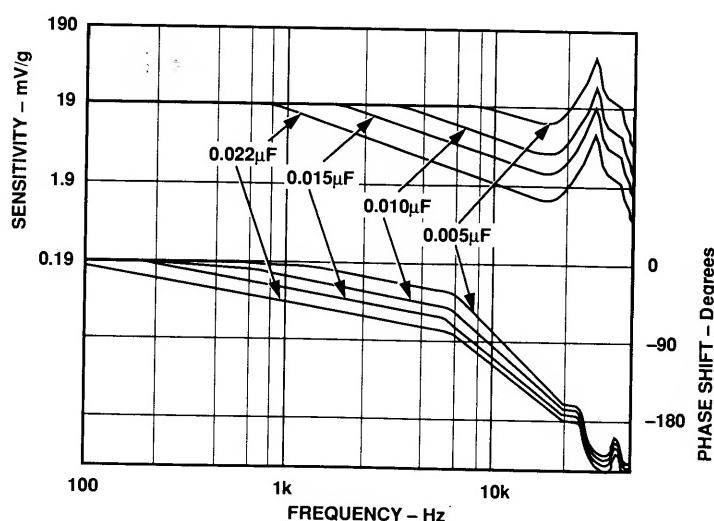


Figure 1. Frequency Response of the ADXL50 for Various Demodulator Capacitors.